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Effect of Plant Extracts on Post Flowering Insect Pests and Grain Yield of Cowpea (Vigna Unguiculata) (L.) Walp.) in Maiduguri, Semi Arid Zone of Nigeria

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Abstract
Field experiment was conducted in Maiduguri located in the semi-arid zone of North eastern Nigeria during 2009 and 2010 rainy seasons.The reason for using these plant materials was due to their presence and ease of preparation in the locality. The effect of balanites (*Balanites aegyptiaca Del*), *Momordica balsamina;* bitter leaf (*Vernonia amygdalina L*) and a standard synthetic insecticide cypermethrin 10% EC replicated four times each and sprayed at 10% w/v concentration were investigated on cowpea post flowering insect pests. The experiment was carried out in a randomized complete block design (RCBD). The result obtained showed that balanites leaf and momordica leaf extracts significantly ($P \leq 0.05$) reduced the infestation of *Maruca vitrata F; Clavigralla tomentosicollis Stal; Anoplonemis curvipes L; Riptortus dentipes F; Mirperus jaculus L and Nezara viridula L.*. Pods and Seeds damage were also significantly higher ($P \leq 0.05$) reduced by these plant extracts compared to bitter leaf sprayed plots and unsprayed control plots. Undamaged Pods, number of Pods/plants, Pod and Seed weight/plant were significantly ($P \leq 0.05$) increased in both plant extracts sprayed plots compared with bitter leaf extracts and control plots. Balanites leaf and Momordica leaf extracts sprayed plots produced significant ($P \leq 0.05$) total grain yield per hectare at 7 – days spray intervals. Cypermethrin insecticide gave the overall best results being a systemic and contact acting standard insecticide. Farmers could therefore adopt balanites and Momordica leaf extracts as alternative to synthetic insecticides for optimum cowpea production in Maiduguri.
Key words: Plant extracts, Cypermthrin, Post flowering, insect pests, grain yield, semi arid

Introduction

Cowpea (*Vigna unguiculata*) (L.) Walp) is a leguminous crop, native of the drier regions (Jefferson, 2005) it is a primary source of plant protein, the grain shelled/dried peas, leaf, green pods and fresh shelled grain peas are great sources of food and vegetables for human diets, as well as a fodder for farm animals. The percentage nutritional value of cowpea indicated its protein content to be 23%, fats 1.3%, fibre 1.8%, carbohydrate, 67% and water 8 – 9% (Jefferson, 2005). Cowpea also serves as a cover crop important for nitrogen fixation (Asiwe *et al;* 2009) Majority of people in the developing countries including Nigeria are engaged in cowpea production, but productivity is low due to insect pests attack (Jackai and Daoust, (1986), Singh *et al;* (2000) and Amatobi *et al*; 2005). Post flowering insect pests are considered to be largely responsible for the low cowpea production. In the North eastern region and northern Nigeria as a whole (Oerke and Dehne, 2004; Sharah and Ali, 2008). Damage from Insect pests such as pod borers (*Maruca vitrata F.)* Pod – sucking bugs (PSBs) complex of which *Clavigralla sp, Anoplocnemis sp., Nezara sp., Riptortus dentipes and Mirperus jaculus* could lead to losses of cowpea grains both in the field and store (NRI, 1996, Amatobi *et al.*, 2005 and Dzemo *et al.*, 2010). However, cowpea yield in Northern Nigeria can be improved and raised to many fold when insect pests are controlled. The use of synthetic insecticides, biological controls, physical control and plant materials have been experimented by many researchers to control post flowering insect pests in cowpea production in recent years (Sharah and Ali, 2008). The use of plant extracts that have insecticidal activity for insect pests control is one of the most effective and promising alternative control measures to synthetic chemicals since it is economically, environmentally safe, less hazardous to humans and often less toxic to ecologically beneficial insects as well as the development of resistance by insect pests. Furthermore, synthetic insecticides are not affordable to majority of peasant farmers (Ogunwolu and Ameh 1999; Sharah and Ali 2008). This study therefore aims to investigate the effect of balanites, Momordica and bitter leaf extracts for the control of cowpea post flowering insect pests in Maiduguri situated in the semi arid zone of North eastern Nigeria.

MATERIALS AND METHODS

Field experiment was conducted at the teaching and research farm of Faculty of Agriculture, University of Maiduguri situated at the semi arid zone of North eastern Nigeria during 2009 and 2010 rainy seasons (June - November) to investigate the effect of *Balanites aegyptiaca* Del. wildly grown in the sahel region, *Momordica balsamina L.* a creeping shrub wildly grown in the semi arid zone and bitter leaf, *Vernonia amygdalina* commonly grown by people at their backyard as vegetable and ornamental plant in the region and a standard synthetic insecticide cypermethrin 10% EC which is a systemic and stomach poisoning insecticide very effective in the control of pod sucking bugs (PSBs) was used for comparison on post flowering insect pests and grain yield of cowpea (*Vigna unguiculata*) in Maiduguri.

The land was harrowed and manually ridged at 0.75 m apart using a hoe. The experimental area was divided into plots separated by an alley of 2.0 m. Each plot was of 4.0 m x 3.0 m (12.0 m^2) spaced at 1.0 m in between plots. The experiment was laid in a randomized complete block design (RCBD) replicated four times. Borno brown cowpea variety seeds which is an early maturing, semi – erect having red seed coat colour sourced from Borno State Agricultural Development Programme (BOSADP) was dressed with Allstar 45WP used for controlling soil pests that could feed on the germinating seedlings sown at 2 – 3 cm depth within intra row spacing of 30 cm and inter row spacing of 75 cm apart. The cowpea seedlings were later thinned to two plants per stand at one week after germination (WAG). Gap filling was done at two weeks after germination (2WAG) to maintain the optimum plant population of 36 stands per plot. Weeding was done at 3, 6 and 9 weeks, after sowing (WAS).

Fresh and clean leaves of balanites, Momodica and bitter leaf were obtained from the university Farm and Botanical garden near gate 6. They were pounded into paste. The paste from each plant was weighed 10 g and poured into 500 ml conical flask containing 100 ml clean water and was manually stirred thoroughly for 10 minutes. The mixture (plant paste and water) were left for 2 hours and thereafter sieved using a Muslin cloth to get the 10% w/v concentration (Jackai *et al.*, 1992) filtrate.The spraying of the plant extracts was done at one week (7 - days) interval using Knapsack sprayer beginning from flower bud initiation when the pod borers and PSBs were seen feeding on the flower buds and stopped when most of the pods were matured and turned brown ready for harvesting. The population count of the pod borers and PSBs was counted physically on ten randomly tagged cowpea plants from each plot; damaged pods, undamaged pods, pods and seeds number per plant and pods, pods and seeds weights per plant were taken at pod maturity. Also at the physiological maturity of the cowpea, pods were harvested by hand. Harvesting was done twice for each plot. Harvested pods were kept in a well labeled polythene bags, then later threshed, winnowed and weighed using metter balance.

Data obtained from those paramaters were subjected to analysis of variance (ANOVA) using statistix 8.0 version and their means separated using least significant differences (LSD).

RESULTS

Effect of Plant Extracts and Cypermethrin Spray on Cowpea Post Flowering Insect Pests

The result presented in (Table 1) showed that there were 3 groups (A, B, C) in which the means were not significantly different ($P \geq 0.05$) from one another when podborer, *Maruca vitrata* infestation was compared among the treatments, cypermethrin (0.25) and balanites (0.45) treatments significantly reduced the pod borers better followed by Momordica (1.50) and bitter leaf (1.75) treatments while unsprayed control (4.80) did not significantly reduced the pod borer.

There were 4 groups (A, B, BC and C) in which the means were not significantly different from one another (Table 1). Balanites (0.20) significantly ($P \leq 0.05$) reduced *Clavigralla sp* infestations better than cypermethrin (0.50) and bitterleaf (0.50) while Momordica (1.00) was the least in reducing the spiny brown bug infestation. Untreated control plots (3.25) did not significantly reduce the bug infestation.

The effect of balanites (0.25) cypermethrin (0.30) Momordica (0.30) were significantly better In the reduction of the giant brown bug *Anoplocnemis spp* infestation than bitter leaf (0.50) while control (7.75) did not significantly reduced the infestations of the pest. *Riptortus dentipes and Mirperus jaculus* infestations were significantly reduced by balanites, momordica, cypermethrin and bitter leaf but untreated control did not significantly reduced these pests population.

Nezara viridula (green stink bug) infestation was significantly ($P \leq 0.05$) reduced under those

treatments that received cypermethrin (0.10) and balanites (0.20) and were followed closely by Momordica (0.50) and bitter leaf (0.80) treatments but control (3.90) plots infestations were not reduced.

Table 1: Effect of Plant Extracts and Cypermethrin Spray on Cowpea Post Flowering Insect Pests

	Mean insect pests count					
Treatment	**Monica spp**	**Clavegralla**	**Anoplocnemis**	**Riptortus**	**Mirperus**	**Nesara**
Balanites leaf	0.45 c	0.20 c	0.25 c	0.30 b	0.60 b	0.20 c
Momordica	1.50 b	1.00 b	0.30 c	0.75 b	0.10 b	0.50 c
Bitter leaf	1.75 b	0.50 Bc	0.50 b	1.00 b	0.26 b	0.80 b
Cypermet-hrin	0.25 c	0.50 Bc	0.30 c	0.50 b	0.20 b	0.10 c
Control	4.80 a	3.25 a	7.75 a	6.00 b	2.15 a	3.90 a
SE ±	0.13	0.33	0.09	0.34	0.33	0.22
LSD (0.05)	0.29	0.72	0.19	0.75	0.73	0.48

Means with same letters are not significantly different at 5 % level of probability

Effect of Plant Extracts and Cypermethrin Spray on Pod Damage

There were 3 groups (A,B, and C) in which the means were not significantly ($P \leq 0.05$) from one another when pod damage were compared among the five treatments (Table 2) Cypermethrin (4.67), momordica (5.10) and balanites (5.33) sprayed plots significantly had low damaged pods followed by bitter leaf (6.90) while unsprayed control (10.33) plots had high damaged pods. When the undamaged pods were compared among the treatments, there were 5 groups (A, AB, BC & D) in which the means were not significantly different from one another. Cypermethrin (21.33) treated plots differ significantly in reducing the pods from being damaged and was closely followed by balanites (19.42), Momordica (18.23) and bitter leaf (15.70) sprayed plots. Unsprayed control (5.90) plots had the least undamaged pods.

TABLE 2: Effect of Plant Extracts and Cypermethrin spray on Pod damage

	Mean number of damaged and undamaged Pods	
Treatment	**Damaged pods**	**Undamaged pods**
Balanites	5.33 c	19.42 ab
Momordica	5.10 c	18.23 b
Bitter leaf	6.90 b	15.70 c
Cypermethrin	4.67 c	21.33 a
Control	10.33 a	5.90 d
SE ±	0.64	1.16
LSD (0.05)	1.40	2.53

Means with the same letter are not significantly different at 5 % level of probability.

Effect of Plant Extracts and Cypermethrin Spray on Number of Pods and Pod Weight

Table 3 show the effect of the four treatments and control on number of pods and their corresponding weight per plant. There were 5 groups (A, AB, BC, C and D) in which the means were not significantly different ($P < 0.05$) from one another. Cypermethrin (26.00) had produced more pods/plant followed closely by balanites (24.75), Momordica (23.33) and bitter leaf (22.67) sprayed plots while unsprayed control (16.21) plots had the lowest number of cowpea pods/plant when the pods weight per plant were paired and compared among the treatments, 4 groups (A,B,C and D) were found to have their means not significantly different from one another, cypermethrin sprayed plots (17.10) had the highest pod weight/plant followed by balanites (15.27) and Momordica (14.30) while bitter leaf had only 12.40 pod weight/plant. Control plots which was not sprayed had the least pod weight/plant of 9.27.

Table 3: Effect of Plant Extracts and Cypermethrin spray on Mean Pod Number and Weight

		Mean Pod number and weight/plant
Treatment	**Pods/Plant**	**Pod weight (g)/plant**
Balanites	24.75 ab	15.27 b
Momordica	23.33 bc	14.30 b
Bitter leaf	22.67 c	12.40 c
Cypermethrin	26.00 a	17.10 a
Control	16.21 d	9.27 d
SE ±	0.80	0.46
LSD (0.05)	1.75	1.01

Means with the same letter are not significantly different at 5 % level of probability.

Effect of Plant Extracts and Cypermethrin Spray on Seed Number and Seed Weight per Plant

Cypermethrin sprayed plots produced more seeds per pod (13.62) followed closely by balanites (10.79) and Momordica (10.14). Bitter leaf sprayed plots had 9.56 seeds/pod while unsprayed control plots had the least seeds/pod of (5.48) and was significantly different from the sprayed plots (Table 4). When seed weight in grammes per plant of the cowpea were paired and compared among the treatments, it was found that cypermethrin sprayed plots had the highest seed weight (18.93) followed by balanites (15.11), Momordica (14.88) and bitter leaf (14.69) and the three were not significantly different ($P \geq 0.05$) from one another unsprayed control plots with only (10.33) was significantly the lowest seed weight/plant.

TABLE 4: Effect of Plant Extracts and Cypermethrin spray on mean number of seeds and seed weight per plant

		Mean seeds number and weight/plant
Treatment	**Seeds/Pod**	**Seed Weight (g)/plant**
Balanites	10.79 b	15.11 b
Momordica	10.14 b	14.88 b
Bitter leaf	9.56 c	14.69 b
Cypermethrin	13.62 a	18.93 a
Control	5.48 d	10.33 c
SE ±	0.31	0.47
LSD (0.05)	0.67	1.03

Means with the same letter are not significantly different at 5 % level of probability

Effect of Plant Extracts and Cypermethrin Spray on Total Cowpea Grain Yield

The result presented in (Table 5) show that there were no significant different ($P \geq 0.05$) among balanites (975.60), Momordica (941.80) and bitter leaf (885.70) sprayed plots when their total grain yield means were paired and compared. Cypermethrin sprayed produced the highest grain yield (1209.30) while unsprayed control plots produced the lowest cowpea grain yield (306.67) and there was significantly difference ($P \leq 0.05$) between those plots that received spray and the one that did not receive spray.

Table 5: Effect of plant extracts and Cypermethrin spray on grain yield

	Mean grain yield
Treatment	**Grain yield (g)**
Balanites	975.60 b
Momordica	941.80 b
Bitter leaf	885.70 b
Cypermethrin	1209.30 a
Control	306.67 c
SE ±	63.08
LSD (0.05)	137.44

Mean with the same letter are not significantly different at 5% level of probability.

DISCUSSION

Cowpea *Vigna unguiculata (L.) Walp)* is known to loss up to 90% of its flowers due to flower pests during flowering and this could negatively affect the number of pods formed and the total grain yield (Amatobi, 1994). Podding could also be affected seriously by post flowering insect pests if not properly and adequately treated against these pests (Muthomi *et al;* 2007). The infestation of the cowpea was significantly reduced through the application of the plant extracts and cypermethrin because of their effective deterrent and suppressant activity of their active ingredients on the pests (Jackai *et al.*, 1992 and Operacke *et al.*, 2000). Balanites and Momordica plant extracts showed better protection of the flower and pod damaging insect pests hence the higher number of undamaged pods, more pods/plant, more seeds/pod and higher grain yield obtained in these sprayed plots. The findings of this study are supported by those of Dzemo *et al* (2010), Ogunwolu and Ameh (1999) who reported that aqueous plant extracts significantly reduced the infestation of pod borers and pod sucking bugs (PSBs) on cowpea thereby reducing pod and seed damage and increasing grain yield.

Cowpea grain yield from plots sprayed with balanites, momordica and bitter leaf during the podding stage of cowpea did differ significantly from yields obtained from unsprayed control plots suggesting that damage inflicted to cowpea by post flowering insect pests at this stage did reduce yield from the unsprayed control plots. This implies that cowpea post flowering pests are serious threat to cowpea production in Maiduguri, Nigeria. This result confirms the findings of Manawadu and Sharah (1990), Sharah and Ali (2008) who found that insect pests infestation at flowering and podding stages are a significant limiting factor to increased and sustainable cowpea grain production. Pod borers and Pod – sucking Insect pests like *Maruca vitrata, Clavigralla spp, Anoplocnemics sp, Riptortus sp, Mirperus sp Neizara sp* and other post flowering pests of the reproductive structures of cowpea with early feeding leading to flower abortion, pod shriveling and seed damage are important and hence poor grain yield (Dzemo *et al.*, 2010). The plant extracts spray at the post – flowering stage control the pests and ensured optimal pod and seed protection.

CONCLUSION

Results from this study clearly showed that balanites and momordica application were effective against the major post flowering insect pests of cowpea. They can offer an alternative to the synthetic insecticides because of their availability in the semi-arid zone, friendliness to human and environment, relative cheapness and easy application by peasant farmers. This work has established that balanites and Momordica extracts have significantly reduced post flowering insect pests and increased grain yield of cowpea in the field. The application of these plant extracts at 10% w/v concentration at 7 – days intervals is

therefore recommended to cowpea producers in Maiduguri area.

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